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Martin T. Pearson

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EXAMINER

CANTELMO, GREGG

ART UNIT

PAPER NUMBER

1745

DATE MAILED: 06/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/017,470	PEARSON, MARTIN T.	
	Examiner	Art Unit	
	Gregg Cantelmo	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 March 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-63 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 58-63 is/are allowed.
- 6) ☒ Claim(s) 1-57 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>April 14, 2004</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. In response to the amendment received March 16, 2004:
 - a. The specification and drawing objections have been withdrawn in light of the amendment;
 - b. The 112 rejections have been overcome or withdrawn in light of the amendment;
 - c. The 102 rejection of Werth as applied to claim 37 stands;
 - d. The 102 and 103 rejections to Yamamoto stand;
 - e. The obviousness-type double patenting rejection has been overcome in light of the Terminal Disclaimer.

Response to Declaration

2. The declaration filed March 10, 2004 has been considered. It should be noted that the reference identified in item 9 is not cited on a supplemental IDS.

Information Disclosure Statement

3. The information disclosure statement filed April 14, 2004 has been placed in the application file and the information referred to therein has been considered as to the merits.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claim 37 is rejected under 35 U.S.C. 102(b) as being anticipated by U.S. patent No. 4,931,947 (Werth).

Werth discloses a method of operating a fuel cell comprising: electrically coupling a fuel cell stack 10 having plural cells with a battery having plural cells 12 and 14 and supplying current to a load device 16 to the stack and cells (Fig. 1 as applied to claim 37).

Response to Arguments

6. Applicant's arguments filed March 16, 2004 have been fully considered but they are not persuasive.

Applicant argues that Werth does not disclose electrically coupling portions of a battery having a plurality of battery cells in parallel with portions of a fuel cell stack having a plurality of fuel cells.

The Examiner respectfully disagrees.

Werth discloses a battery having a plurality of cells 12 and 14 which are electrically connected in parallel with the fuel cell stack 10 which has plural cells therein. Furthermore in Werth, the sum of the battery cells is coupled in parallel across the respective sum of the fuel cell stack.

The term portions in claim 37 lacks sufficient specificity and thus can be either some or all portions of the battery and fuel cell stack.

Therefore it is held that Werth still anticipates claim 37 and the rejection stands.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 37-43 and 47-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto in view of U.S. patent No. 4,931,947 (Werth).

Yamamoto discloses a fuel cell apparatus and method of operating comprising: supplying current to the load 5 from at least one of a fuel cell stack 3 (note that the term stack has been interpreted be one or more fuel cells) and a battery 6 electrically coupled in parallel with the fuel cell stack 3; determining an operational condition of the battery 6; determining an amount of deviation of the determined operational condition of the battery from a desired operational condition of the battery; and for at least one reactant flow (fuel pump 7 and air blower 9 to the fuel cell) to at least a portion of the fuel cell stack, adjusting a partial pressure of the reactant flow based on the determined amount of deviation (Fig. 1, col. 2, ll. 47-67, col. 3, ll. 10-35 and col. 4, ll. 1-64 as applied to claims 37, 38 and 41).

A control circuit 12,15 and I_{fc} coupled to receive signals corresponding to an operating condition of the battery and configured to determine a deviation of the operating condition of the battery from a desired operational condition of the battery based on the received signals, the control circuit further coupled to control the at least first control element (blower or fuel pump) based on the determined deviation (Fig. 1 as applied to claim 42).

A control circuit 12,15 and I_{fc} coupled to receive signals corresponding to an operating condition of the battery and configured to determine a deviation of the operating condition of the battery from a desired operational condition of the battery based on the received signals, the control circuit further coupled to control the at least first control element (blower or fuel pump) based on the determined deviation. The control circuit is coupled to the battery current sensor for receiving data regarding the current of the battery. The control circuit is also coupled to the fuel cell reactant fuel pump and oxidant blower to control the rates of flow of the fuel and oxidant to the fuel cell (Fig. 1 as applied to claim 47).

The method and apparatus further includes determining current flow into and out of the battery 6 over a period of time via current detector 11 (Fig. 1 and col. 4, ll. 13-20 as applied to claims 39 and 48).

The determining an operational condition of the battery includes determining a voltage across the battery via voltage detector 13 (Fig. 1 as applied to claims 40 and 49).

The differences between claims 41 and 43 are of using groups of the battery cells (claim 41) and wherein the groups of battery cells each include a single cell (claim 43).

Yamamoto exemplifies a single battery in connection with the load and fuel cell. It is known to employ plural groups of single cell batteries as shown by Werth (Fig. 1).

The motivation for using plural batteries is that a multiple-battery system enhances system reliability by avoiding the problem of a single bad cell in one of the batteries causing the entire system to become inoperable. The concept also provides operational flexibility in that, while one battery is being cycled, the other battery equalizes and cools off. The system also enhances flexibility in system configuration and package design. This embodiment also provides means for enhancing the overall efficiency of the hybrid system since various energy source combinations are possible depending on the battery charge level and the current load. Switching between the power sources is arranged to provide for maximum efficiency by allowing the fuel cell stack to operate close to its average rated power output for all load demand conditions. The fuel cell, when connected to the load, is also utilized to charge the batteries as appropriate, the shifting of load to the fuel cell stack minimizing battery-run down by avoiding battery overcharge or overdischarge. This aspect extends battery life (col. 3, ll. 16-35).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by using plural batteries since it would have enhanced system reliability by avoiding the problem of a

single bad cell in one of the batteries causing the entire system to become inoperable. The concept also would have provided operational flexibility in that, while one battery is being cycled, the other battery equalizes and cools off. The system also would have enhanced flexibility in system configuration and package design. This embodiment also would have provided means for enhancing the overall efficiency of the hybrid system since various energy source combinations are possible depending on the battery charge level and the current load. Switching between the power sources would have provided for maximum efficiency by allowing the fuel cell stack to operate close to its average rated power output for all load demand conditions. This also would have reduced the shifting of load to the fuel cell stack minimizing battery-run down by avoiding battery overcharge or overdischarge.

9. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto in view of Werth as applied to claim 41 above and in further view of 4,721,660 (Kujas).

The teachings of Yamamoto have been discussed above and are incorporated herein.

The difference not yet discussed is of the number of fuel cells in each of the groups being greater than the number of battery cells in the groups of cells (claim 45).

With respect to claim 45:

It is well known in the art that individual fuel cells have a much lower voltage output than other batteries, generally less than 1 volt per cell (Kujas, col. 2, ll. 21-38). In order to generate a desired voltage output comparable to the voltage output of the

battery, 12 Volts, it would have been obvious to provide more fuel cells in the stack relative to the batteries so that the voltage output of both the fuel cell stack and batteries are identical.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by providing more fuel cells in the stack relative to the batteries since it would have provided an arrangement wherein the voltage output of both the fuel cell stack and batteries were identical.

10. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto in view of Werth as applied to claim 41 above and in further view of U.S. patent Nos. 6,100,665 (Alderman) and 5,318,142 (Bates).

The teachings of Yamamoto have been discussed above and are incorporated herein.

The difference not yet discussed is providing a super capacitor in parallel across the battery.

Alderman discloses providing capacitors in parallel across the electrical power system which includes both a battery 18 and fuel cell 14 (Fig. 2).

The motivation for providing capacitors in parallel across the battery is that it improves the charging of the battery.

Supercapictors are known as high power/low energy devices (Bates, col. 5, ll. 6-18).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by providing a capacitor in parallel with the battery since it would have improved the charging of the battery.

It would have further been obvious to ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by providing a super capacitor since it would have improved the power of the system at a lower operating energy.

Response to Arguments

11. Applicant's arguments filed March 16, 2004 have been fully considered but they are not persuasive.

See the response to arguments to the 102 rejection of claim 37 above, incorporated herein.

Claim Rejections - 35 USC § 102

12. Claims 21-23, 26-33, 35-36, 50-53 and 55-57 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. patent No. 4,883,723 (Yamamoto).

With respect to the system: Yamamoto discloses a fuel cell system for providing power to a load 5, comprising: a fuel cell stack 3 having a number of fuel cells (interpreted as one or more fuel cells); a battery 6 having a number of battery cells (interpreted as one or more batteries) electrically couplable in parallel across the fuel cell stack 3; a reactant delivery system (including methanol tank 1, fuel pump 7, air blower 9) for delivering reactant to the fuel cells, the reactant delivery system including

at least a first control element (pump 7 or blower 9) adjustable to control a partial pressure in a flow of a reactant to at least some of the fuel cells; and a control circuit 12,15 and I_{fc} coupled to receive signals corresponding to an operating condition of the battery and configured to determine a deviation of the operating condition of the battery from a desired operational condition of the battery based on the received signals, the control circuit further coupled to control the at least first control element based on the determined deviation (Fig. 1 as applied to claims 21, 29, 33, 35, 50, 53 and 56).

Current sensor 11 is coupled to measure a flow of current into and out of the battery and to provide the measured flow of current to the control circuit as the signals corresponding to the operating condition of the battery (Fig. 1 as applied to claim 22).

Voltage sensor 13 is coupled to measure a voltage across the battery and to provide the measured voltage to the control circuit as the signals corresponding to the operating condition of the battery (Fig. 2 as applied to claim 23).

The battery and fuel cells are coupled in parallel (Fig. 1 as applied to claim 27).

A control circuit 12,15 and I_{fc} coupled to receive signals corresponding to an operating condition of the battery and configured to determine a deviation of the operating condition of the battery from a desired operational condition of the battery based on the received signals, the control circuit further coupled to control the at least first control element (blower or fuel pump) based on the determined deviation (Fig. 1 as applied to claim 30).

The control circuit is coupled to the battery current sensor for receiving data regarding the current of the battery. The control circuit is also coupled to the fuel cell

reactant fuel pump and oxidant blower to control the rates of flow of the fuel and oxidant to the fuel cell (Fig. 1 as applied to claims 31 and 51).

The control circuit is coupled to the battery voltage sensor for receiving data regarding the voltage of the battery. The control circuit is also coupled to the fuel cell reactant fuel pump and oxidant blower to control the rates of flow of the fuel and oxidant to the fuel cell (Fig. 1 as applied to claims 32 and 52).

Voltmeter 13 in conjunction with the controller 12 is construed to be a voltage regulator since the sensed conditions of the battery are supplied to the controller to analyze the incoming signals and make the necessary adjustments to the system to compensate for variations in battery conditions. Additionally note that the specification fails to clearly define what the instant invention construes to be a "voltage regulator" (Fig. 1 as applied to claim 36).

With respect to the apparatus claims and limitations therein drawn to the operation of the apparatus (claims 28, 30-32, 51-52 and 56-57): Yamamoto discloses that the control unit is configured to control the fuel pump and oxidant blower for providing the reactants to the fuel cell. The structure of the apparatus of Yamamoto does not appear to be different from the claimed invention. And the manner of using the configuration of claim 28 is not significant with respect to the apparatus since the manner of using does not structurally define the apparatus.

While intended use recitations and other types of functional language cannot be entirely disregarded. However, in apparatus, article, and composition claims, intended use must result in a structural difference between the claimed invention and the prior art

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in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. In re Casey, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); In re Otto, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963).

Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. In re Danly, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). See also MPEP § 2114.

The manner of operating the device does not differentiate an apparatus claim from the prior art. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

Response to Arguments

13. Applicant's arguments filed March 16, 2004 have been fully considered but they are not persuasive.

Applicant argues that Yamamoto does not disclose electrically coupling portions of a battery having a plurality of battery cells in parallel with portions of a fuel cell stack having a plurality of fuel cells.

The Examiner respectfully disagrees.

Yamamoto discloses a battery having a plurality of cells which are electrically connected in parallel with the fuel cell stack which has plural cells therein. Furthermore in Yamamoto, the sum of the battery cells is coupled in parallel across the respective sum of the fuel cell stack.

The term portions in the claims lack sufficient specificity and thus can be either some or all portions of the battery and fuel cell stack.

As stated above, the prior art apparatus has the same structural features as the claimed invention.

However, in apparatus, article, and composition claims, intended use must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim.

In particular the prior art comprises a control unit which controls the various parameters of the system including reactant flow rate to the fuel cell. Thus the prior art structure which includes all of the structural features of the instant claims, is further capable of performing the intended uses of the claims. In view of this, the prior art apparatus is still held to anticipate the apparatus claims.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. Claims 24, 25, 34 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto in view of U.S. patent No. 3,800,208 (Macharg).

The teachings of Yamamoto have been discussed above and are incorporated herein.

The differences between claims 24, 25, 34 and 54 and Yamamoto are that Yamamoto does not disclose of providing an integrator and comparator (claims 24, 25, 34 and 54).

Macharg discloses of using an integrator and comparator to integrating the difference between a nominal charge and full charge of the battery.

The motivation for using the arrangement and function of the integrator and comparator of Macharg is that it provides a means to monitor the state of the battery and respond to variances in the charge of the battery to optimize charge of the battery and the power to the load.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by using an integrator and comparator and integrating the difference between a nominal charge and full charge of the battery since it would have provided a means to monitor the state of the battery and responded to variances in the charge of the battery to have optimized the charge of the battery and power to the load.

Response to Arguments

16. Applicant's arguments filed March 16, 2004 have been fully considered but they are not persuasive.

Applicant does not provide convincing arguments as to the differences in the prior art apparatus as applied to the instant claims.

While intended use recitations and other types of functional language cannot be entirely disregarded. However, in apparatus, article, and composition claims, intended use must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. In re Casey, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); In re Otto, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963).

Claim Rejections - 35 USC § 103

17. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto in view of U.S. patent No. 5,339,018 (Brokaw).

The teachings of Yamamoto have been discussed above and are incorporated herein.

The difference between claim 25 and Yamamoto is that Yamamoto does not disclose of using an alternator controller.

Brokaw discloses using an alternator controller in combination with a battery power circuit in order to control the excitation current of the alternator as a function of the battery voltage (col. 4, ll. 40-50).

The motivation for using an alternating controller is that it controls the excitation current of the alternator as a function of the battery voltage.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by using an alternating controller since it would have controlled the excitation current of the alternator as a function of the battery voltage.

18. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto in view of U.S. patent No. 4,839,574 (Takabayashi).

The teachings of Yamamoto have been discussed above and are incorporated herein.

The difference between claim 26 and Yamamoto is that Yamamoto does not disclose of using a microprocessor.

Takabayashi discloses a similar arrangement to Yamamoto (see Fig. 1 of each reference). Takabayashi discloses using a microprocessor for the control system 12.

The motivation for using a microprocessor is that it would have provided a means for automating the system.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by using a

microprocessor as taught by Takabayashi since it would have provided means for automating the system.

Response to Arguments

19. Applicant fails to provide further arguments to the rejections of claims 25 and 26 above apart from those issues argued and applied to the 102 rejection of Yamamoto, discussed above and incorporated herein.

Claim Rejections - 35 USC § 103

20. Claims 1, 2, 5-7, 9-11, 13, 16-17, 50-53 and 55-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto in view of U.S. patent No. 4,904,548 (Tajima).

With respect to the method claims, Yamamoto discloses a fuel cell apparatus and method of operating comprising: supplying current to the load 5 from at least one of a fuel cell stack 3 (note that the term stack has been interpreted be one or more fuel cells) and a battery 6 electrically coupled in parallel with the fuel cell stack 3; determining an operational condition of the battery 6; determining an amount of deviation of the determined operational condition of the battery from a desired operational condition of the battery; and for at least one reactant flow (fuel pump 7 and air blower 9 to the fuel cell) to at least a portion of the fuel cell stack, adjusting a partial pressure of the reactant flow based on the determined amount of deviation (Fig. 1, col. 2, ll. 47-67, col. 3, ll. 10-35 and col. 4, ll. 1-64 as applied to claims 1, 9, 13 and 17).

The method includes determining current flow into and out of the battery 6 over a period of time via current detector 11 (Fig. 1 and col. 4, ll. 13-20 as applied to claim 2).

The determining an operational condition of the battery includes determining a voltage across the battery via voltage detector 13 (Fig. 1 as applied to claim 5).

The determining an amount of deviation of the determined operational condition of the battery from a desired battery operational condition includes comparing a determined battery charge to a defined desired nominal battery charge (col. 3, ll. 10-31 and col. 4, ll. 13-64 as applied to claim 6).

The controller adjusts the air blower 9 and fuel cell methanol reactant pump 7 in response to the deviation in the comparison between the actual system conditions of the battery (voltage, current and capacity) to the target conditions (col. 4, ll. 36-64 as applied to claim 7).

The method includes determining current flow into and out of the battery 6 over a period of time via current detector 11 and determining the voltage of the battery via detector 13 (Fig. 1 and col. 4, ll. 13-29) and adjusting the air blower 9 and fuel cell methanol reactant pump 7 in response to the deviation in the comparison between the actual system conditions of the battery (voltage, current and capacity) to the target conditions (col. 4, ll. 36-64 as applied to claims 10 and 11).

The desired nominal charge of the battery is at least 80% (col. 3, ll. 10-20) which is between approximately 75% and approximately 95% percent of a full charge for the battery (as applied to claim 15).

With respect to the system: Yamamoto discloses a fuel cell system for providing power to a load 5, comprising: a fuel cell stack 3 having a number of fuel cells (interpreted as one or more fuel cells); a battery 6 having a number of battery cells (interpreted as one or more batteries) electrically couplable in parallel across the fuel cell stack 3; a reactant delivery system (including methanol tank 1, fuel pump 7, air blower 9) for delivering reactant to the fuel cells, the reactant delivery system including at least a first control element (pump 7 or blower 9) adjustable to control a partial pressure in a flow of a reactant to at least some of the fuel cells; and a control circuit 12, 15 and 16 coupled to receive signals corresponding to an operating condition of the battery and configured to determine a deviation of the operating condition of the battery from a desired operational condition of the battery based on the received signals, the control circuit further coupled to control the at least first control element based on the determined deviation (Fig. 1 as applied to claims 50, 53 and 56).

The control circuit is coupled to the battery current sensor for receiving data regarding the current of the battery. The control circuit is also coupled to the fuel cell reactant fuel pump and oxidant blower to control the rates of flow of the fuel and oxidant to the fuel cell (Fig. 1 as applied to claim 51).

The control circuit is coupled to the battery voltage sensor for receiving data regarding the voltage of the battery. The control circuit is also coupled to the fuel cell reactant fuel pump and oxidant blower to control the rates of flow of the fuel and oxidant to the fuel cell (Fig. 1 as applied to claim 52).

Voltmeter 13 in conjunction with the controller 12 is construed to be a voltage regulator since the sensed conditions of the battery are supplied to the controller to analyze the incoming signals and make the necessary adjustments to the system to compensate for variations in battery conditions. Additionally note that the specification fails to clearly define what the instant invention construes to be a "voltage regulator" (Fig. 1 as applied to claim 55).

With respect to the apparatus claims and limitations therein drawn to the operation of the apparatus (claims 51-52 and 56-57): Yamamoto discloses that the control unit is configured to control the fuel pump and oxidant blower for providing the reactants to the fuel cell. The structure of the apparatus of Yamamoto does not appear to be different from the claimed invention. And the manner of using the configuration of claim 28 is not significant with respect to the apparatus since the manner of using does not structurally define the apparatus.

While intended use recitations and other types of functional language cannot be entirely disregarded. However, in apparatus, article, and composition claims, intended use must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. In re Casey, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); In re Otto, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963).

Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. In re Danly, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). See also MPEP § 2114.

The manner of operating the device does not differentiate an apparatus claim from the prior art. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

The differences between Yamamoto and the instant claims is that Yamamoto does not expressly disclose maintaining the current of the fuel cell stack at a constant voltage (claims 1, 9, 13 and 17) and of determining the relation between the determined deviation and the partial pressure of at least one of the fuel and oxidant flow is based on a polarization curve for the fuel cell stack (claim 16).

With respect to claims 1, 9, 13 and 17:

In order to control a fuel cell having a fuel cell stack to which reformed fuel and oxidizing agent are supplied, an output current from the fuel cell is detected while the voltage of the fuel cell is maintained at a constant voltage and the amount of the fuel and/or the oxidizing agent is controlled in accordance with the detected output current to stably generate electric power. At least one of a plurality of unit cells constituting the

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fuel cell stack is used as a monitoring cell having a current-voltage characteristic curve which is lower than that of the other unit cells, and an output current from the monitoring cell is detected while the voltage of this cell is maintained at a constant voltage, and the supplied amount of the fuel and/or the oxidizing agent is controlled in accordance with the detected current value to stably generate electric power output (abstract of Tajima).

The motivation for maintaining the fuel cell stack at constant voltage and adjusting the fuel and/or reactant in accordance with the detected output current is that it generates stable electric power.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by maintaining the fuel cell stack at constant voltage and adjusting the fuel and/or reactant in accordance with the detected output current as taught by Tajima since it would have generated stable electric power.

With respect to claim 16:

In order to efficiently generate power by increasing the utilization ratio of fuel in the stack 10 to a value which is as high as possible, when the fuel cell is controlled by the above-mentioned method, it is desirable that the power generation is performed in the region dominated by diffusion polarization or the curved portion rapidly lowering the voltage value in the I-V curve rather than in the region dominated by resistance polarization or the straight line portion of the I-V curve (Tajima, col. 9, ll. 56-64).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by basing the mathematical relation between the deviation and partial pressure based on a polarization curve is that it would have efficiently generated power by increasing the utilization ratio of fuel in the stack to a value which is as high as possible.

Response to Arguments

21. Applicant's arguments with respect to claims 1, 2, 5-7, 9-11, 13, 15 and 17 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

22. Claims 3, 4, 14, 15 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto in view of Tajima as applied to claims 1 and 13 above and in further view of U.S. patent No. 3,800,208 (Macharg).

The desired nominal charge of the battery is at least 80% (col. 3, ll. 10-20) which is between approximately 75% and approximately 95% percent of a full charge for the battery (as applied to claim 15).

The teachings of Yamamoto and Tajima have been discussed above and are incorporated herein.

The differences between claims 3, 4, 14 and 15 and Yamamoto are that Yamamoto does not disclose integrating the difference between a nominal charge and full charge (claims 3, 4, 14 and 15) or of providing an integrator (claim 54).

Macharg discloses of using an integrator and comparator to integrating the difference between a nominal charge and full charge of the battery.

The motivation for using the arrangement and function of the integrator and comparator of Macharg is that it provides a means to monitor the state of the battery and respond to variances in the charge of the battery to optimize charge of the battery and the power to the load.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by using an integrator and comparator and integrating the difference between a nominal charge and full charge of the battery since it would have provided a means to monitor the state of the battery and responded to variances in the charge of the battery to have optimized the charge of the battery and power to the load.

23. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto in view of Tajima as applied to claim 17 above and in further view of U.S. patent No. 4,931,947 (Werth).

The teachings of Yamamoto and Tajima have been discussed above and are incorporated herein.

The difference not yet discussed is of using plural batteries in separate cases (claim 20).

Yamamoto exemplifies a single battery in connection with the load and fuel cell. It is known to employ plural batteries in separate cases as shown by Werth (Fig. 1 as applied to claim 20).

The motivation for using plural batteries is that a multiple-battery system enhances system reliability by avoiding the problem of a single bad cell in one of the batteries causing the entire system to become inoperable. The concept also provides operational flexibility in that, while one battery is being cycled, the other battery equalizes and cools off. The system also enhances flexibility in system configuration and package design. This embodiment also provides means for enhancing the overall efficiency of the hybrid system since various energy source combinations are possible depending on the battery charge level and the current load. Switching between the power sources is arranged to provide for maximum efficiency by allowing the fuel cell stack to operate close to its average rated power output for all load demand conditions. The fuel cell, when connected to the load, is also utilized to charge the batteries as appropriate, the shifting of load to the fuel cell stack minimizing battery-run down by avoiding battery overcharge or overdischarge. This aspect extends battery life (col. 3, ll. 16-35).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by using plural batteries since it would have enhanced system reliability by avoiding the problem of a single bad cell in one of the batteries causing the entire system to become inoperable. The concept also would have provided operational flexibility in that, while one battery is being cycled, the other battery equalizes and cools off. The system also would have enhanced flexibility in system configuration and package design. This embodiment also would have provided means for enhancing the overall efficiency of the hybrid system

since various energy source combinations are possible depending on the battery charge level and the current load. Switching between the power sources would have provided for maximum efficiency by allowing the fuel cell stack to operate close to its average rated power output for all load demand conditions. This also would have reduced the shifting of load to the fuel cell stack minimizing battery-run down by avoiding battery overcharge or overdischarge.

24. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto in view of Tajima as applied to claim 17 above and in further view of U.S. patent No. 4,931,947 (Werth) and U.S. patent No. 5,482,790 (Yamada).

The teachings of Yamamoto and Tajima have been discussed above and are incorporated herein.

The difference not yet discussed is of using plural batteries in a single case.

With respect to using plural batteries:

Yamamoto exemplifies a single battery in connection with the load and fuel cell. It is known to employ plural batteries in separate cases as shown by Werth (Fig. 1).

The motivation for using plural batteries is that a multiple-battery system enhances system reliability by avoiding the problem of a single bad cell in one of the batteries causing the entire system to become inoperable. The concept also provides operational flexibility in that, while one battery is being cycled, the other battery equalizes and cools off. The system also enhances flexibility in system configuration and package design. This embodiment also provides means for enhancing the overall

efficiency of the hybrid system since various energy source combinations are possible depending on the battery charge level and the current load. Switching between the power sources is arranged to provide for maximum efficiency by allowing the fuel cell stack to operate close to its average rated power output for all load demand conditions. The fuel cell, when connected to the load, is also utilized to charge the batteries as appropriate, the shifting of load to the fuel cell stack minimizing battery-run down by avoiding battery overcharge or overdischarge. This aspect extends battery life (col. 3, ll. 16-35).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by using plural batteries since it would have enhanced system reliability by avoiding the problem of a single bad cell in one of the batteries causing the entire system to become inoperable. The concept also would have provided operational flexibility in that, while one battery is being cycled, the other battery equalizes and cools off. The system also would have enhanced flexibility in system configuration and package design. This embodiment also would have provided means for enhancing the overall efficiency of the hybrid system since various energy source combinations are possible depending on the battery charge level and the current load. Switching between the power sources would have provided for maximum efficiency by allowing the fuel cell stack to operate close to its average rated power output for all load demand conditions. This also would have reduced the shifting of load to the fuel cell stack minimizing battery-run down by avoiding battery overcharge or overdischarge.

With respect to placing plural batteries in a single case:

Yamada discloses using batteries in separate cases 45a and 45b (Fig. 3) or in a single case 14 (Fig. 7).

The motivation for providing the batteries in a single case is that it reduces the space required for the batteries.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by providing plural batteries in a single case since it would have reduced the size of the overall system by having reduced the space required for the batteries.

25. Claims 8, 12 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto in view of Tajima as applied to claims 1, 9 and 13 above and in further view of Boyer et al. "Evaluation of methods to increase the oxygen partial pressure in PEM fuel cells".

The declaration states that this reference was cited on a supplemental IDS, however the supplemental IDS fails to list this reference. The Examiner is basing the rejection based on the disclosure relied upon in Applicant's declaration. Applicant is requested to furnish a copy of this reference.

The teachings of Yamamoto and Tajima have been discussed above and are incorporated herein.

The difference between claims 8, 12 and 18 and Yamamoto is that Yamamoto does not disclose holding the pressure of the reactant constant while adjusting the partial pressure of the fuel or oxidant flow.

As discussed in Applicants declaration, Boyer teaches of adjusting the oxidant fuel flow while holding the pressure of the reactant flow constant (see item 9 of the affidavit and Boyer reference).

The motivation for adjusting the flow rate of the oxidant partial pressure is to enhance the power output of the cell.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of Yamamoto by adjusting the flow rate of the oxidant partial pressure since it would have enhanced the power output of the cell.

Response to Arguments

26. Applicant's arguments with respect to claims 3, 4, 14, 15, 19 and 20 have been considered but are moot in view of the new ground(s) of rejection.

Terminal Disclaimer

27. The terminal disclaimer filed on March 10, 2004 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. Patent No. 6,573,682 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Allowable Subject Matter

28. Claims 58-63 are allowed.

29. The following is an examiner's statement of reasons for allowance: none of the prior art of record appears to teach, suggest or render obvious the invention of claim 58.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

30. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of


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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregg Cantelmo whose telephone number is (571) 272-1283. The examiner can normally be reached on Monday to Thursday from 9 a.m. to 6 p.m. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan, can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. FAXES received after 4 p.m. will not be processed until the following business day. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Gregg Cantelmo
Primary Examiner
Art Unit 1745

gc



June 14, 2004